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STE6 Translohr Line Châtillon-Vélizy-Viroflay

June 2016

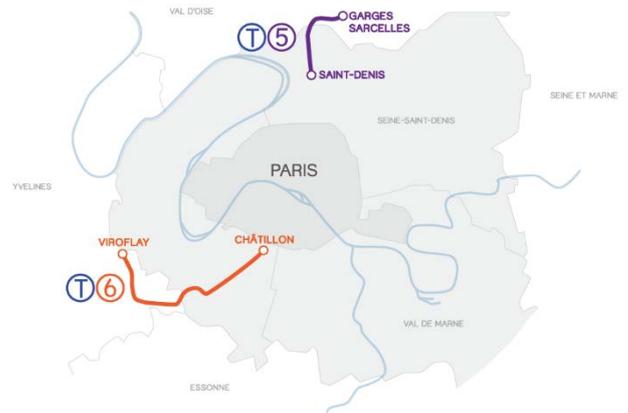
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Translohr in Ile-de-France

The RATP chose the **Translohr STE** tramway on tyres for two lines in Paris:

Paris Nord T5 "Saint-Denis-Sarcelles"

7 km
15 Translohr STE3 trams (25 m) (+4 ordered)
In service since July 2013



Paris Sud T6 "Châtillon-Vélizy-Viroflay"

14 km (including 1.6 km in a tunnel)
10% grades
28 Translohr STE6 trams (46 m)
In service since December 2014



▲ Translohr STE6 on the RATP T6 line.

The T6 line: "Châtillon-Vélizy-Viroflay"

Inaugurated on December 13, 2014, the RATP T6 tramway on tyres is the first line served by the Translohr STE6 model (46 m), the longest tram in the range.

The second stretch of the line (2.6 km) was inaugurated on June 11, 2016 and includes the Viroflay tunnel (1.6 km). This final section represents a major technical challenge for NTL and for Translohr tramways on tyres, with a slope of up to 10% in the tunnel.

Figures:

- **21 stations** including 2 underground (Viroflay-Rive Droite, Viroflay-Rive Gauche)
- **14 km of track**
7.5 km in Hauts-de-Seine
6.5 km in Yvelines
- **9 communes served:** Malakoff, Montrouge, Châtillon, Fontenay-aux-Roses, Le Plessis-Robinson, Clamart, Meudon, Vélizy-Villacoublay, Viroflay
- **4 minutes** between two trains in peak periods (7 minutes in low periods)
- **40 minute** trip from end-to-end
- **82,000 people** carried each day
- **28 trams** in service
- **19 km/h** average speed
- **1 tunnel** 1.6 km long

Key dates of the project:

- **2002:** Basic outline approved by the STIF
- **2006:** Declaration of public worth
- **2007:** Launch of preparatory work
- **2010:** Start of work on the tramway and rolling stock ordered
- **2013:** Delivery of the first tram and start of tests
- **2014:** Line opened from Robert Wagner to Châtillon-Montrouge
- **2016:** Underground section enters service to the Viroflay-Rive Droite stop



The underground portion of the T6 line

A tramway adapted to underground travel, with a 10% slope

The T6 line is the first Translohr tramway on tyres to include a tunnel passage with a large grade (10%). The unique nature of this underground section requires a transport system with the right ability to overcome this slope. Translohr trams are the only kind that can meet this constraint, with an ability to overcome grades of up to 13%.

Overcoming grades

Conducted from October 2015 to April 2016, the dynamic tests in the underground section of the line made it possible to meet three requirements: Qualification of rolling stock, safety and accessibility of the stations, overall security of the guided transport system.

The qualification tests for the rolling stock particularly consist of verifying the traction and braking performance in the tunnel on the large 10% grade: The ability to brake and to start with full load in the slope, and a degraded-mode travel test to exit the tunnel and allow the passengers to evacuate.

Fire/smoke standards

Translohr trams on tyres meet the requirements of fire/smoke standards for the movement of rolling stock through a tunnel. To achieve this, components and materials that limit flammability and the spread of fire were selected and qualified. This is a form of passive security.

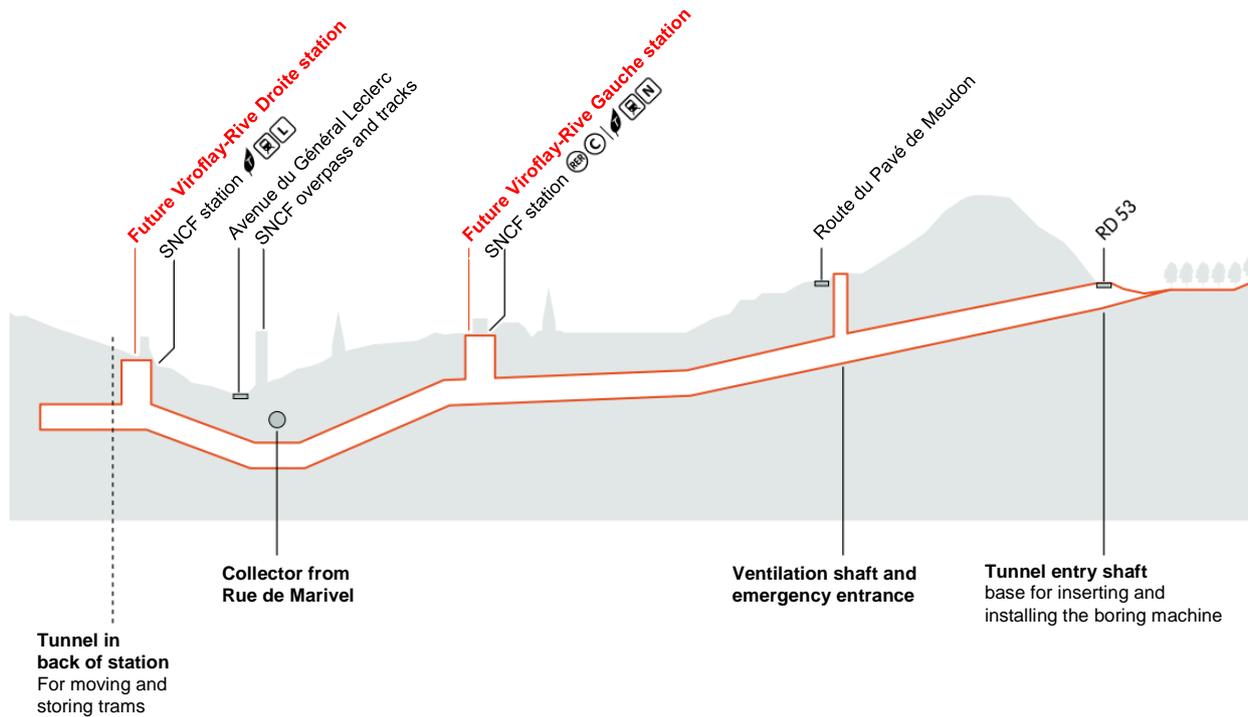
The Translohr also contains so-called "active" safety systems. These include temperature sensors installed near the brakes as well as in the power converters. When an alarm of this type is displayed to the driver, adherence to the Operational protocol allows the Operator to keep the passengers and rolling stock safe.

Viroflay tunnel

Source: Document "S comme... Section souterraine", www.tramway-chatillon-viroflay.fr

The choice to construct, in Viroflay, a part of the line underground is due to geographical features. It also has the benefit of minimizing the urban footprint and disruptions to local residents while preserving the historical and architectural heritage of Viroflay

The station platforms are reached from outside via a stairway attached to an escalator, or via a lift. The platforms, which are 21 meters down, are underneath an architectural structure made up of arches and two mezzanines.



The rolling stock

For the T6 line, the STIF and the RATP chose the STE6, a bidirectional Translohr tramway on tyres model 46m long, made up of 6 cars. Each one can carry up to 255 people (4 people/m²).

Translohr trams are electrical transport systems guided by a central steering rail. As high-capacity surface public transit vehicles with an integral low floor, they are able to run just as well on their own tracks as on mixed-use tracks.

Translohr trams have a **narrow gauge**, ensuring that adherence to the path in all environmental conditions (5.18m dual tangent track).

The benefits of the tyre

The tyre/road grip gives the tram powerful dynamic properties, particularly when it comes to **steep grades** (up to 13%) and in curves. The use of the tyres ensures **silent running**, with tyre/road contact that produces no vibrations or screeching, even in **sharp turns with a radius up to 10.5 m**.

Construction of the trams

The trams are made from rail-car modules:

- End modules (EM) that contain the driver's cabs.
- Passenger modules (PM).
- Interstitial modules (IM) that allow travel between the passenger modules.
- The Translohr STE6 of the T6 line has 7 axles, including 4 motorized axles.

Comfort and accessibility

The stopping accuracy ensures a **smaller gap** between the vehicle and the platform, thereby making it easier to get on and off the tram. **Access** and **movement** are made easier by the integral low floor to accommodate everyone, including wheelchair users.

Passengers can move within the tram from one end to the other, thanks to the continuous low floor. The trams are equipped with wide window bays that ensure great **transparency**, with a modern **design**.

Main specifications

	Unit	STE6
Lifespan	years	30
Number of passenger modules/axles		7
Number of motorized axles		4
Total length	m	46
Total width	m	2.22
Total height at pantograph	m	3.05
Level of floor	m	0.25
Minimum radius of curvature	m	10.5
Maximum speed	km/h	70
Number of doors		12
Power consumption	kWh/km	4 to 6
Sound level	dB(A)	69/75
Unladen mass	T	41.2
Number of EL6 passengers (4-6 pass/m ²)		255/358



▲ Perspective view of a Translohr STE6 tram of the T6 line.



▲ Inside view of a tram



▲ Standard interior layout of a Translohr STE6 tram for the T6 line.

Benefits of Translohr trams

Translohr tramways on tyres combine the benefits of a guided system, with a central rail, and the advantages of a vehicle on tyres, giving them a unique ability to mesh with existing street systems and overcome steep grades. **Narrow turning radius, overcomes 13% grades, silent running.**

How do passengers benefit?

- **Accessibility:**
 - Integral low floor 25 cm from the ground, with a smaller gap in the station
 - Easy to move internally between the passenger modules
- **Comfort:**
 - Silent running (both inside and out)
 - No vibrations or screeching in turns (no iron/iron contact)
- **Security:**
 - Improved braking performance owing to the grip of the tyres
 - Kept on its course by the guiding rail
 - Cab with panoramic view for the driver
- **Frequency & regularity:**
 - A single-route guided system on a dedicated track
 - Modularity (3 to 6 cars) and capacity of the trams (up to 355 passengers)

How does the operator benefit?

- **Eco-mobility:**
 - A non-polluting guided electrical system with no CO₂ or fine particles emissions
 - A lifespan of 30 years
 - A high-capacity tram (up to 358 passengers¹)
 - Range with catenary-free solutions (on-board batteries)
- **Fitting in to the environment:**
 - A tram that adapts to the unique features of the city, thanks to its narrow turning radius: 10.5 m
 - Overcomes grades up to 13% thanks to the grip of the tyres and an additional motor
- **Economic savings:**
 - Fast-to-install system (18 to 24 months)
 - Less cumbersome infrastructure work: Platform only 25 to 30 cm deep, only a single rail to lay down.
 - Smaller footprint: Less land to acquire (expropriation, demolition), smaller footprint for depots

¹ Maximum capacity with 6 people/m² for an STE6.